Car Parking Indicator

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Abstract

The car parking indicator app is designed to assist drivers in finding available parking spaces within a parking lot. Leveraging MATLAB and Simulink, the app provides real-time information on parking availability, guiding users to open spots efficiently via a display on the screen. Key features include a series of checkboxes of the parking lot, an indicator of the available parking spots, and a count of the available parking spots. By visualizing the availability of parking spaces, the app enhances convenience and reduces congestion.

Upon launching the app, users are greeted with a real-time display of parking availability. The app continuously monitors parking spots within a designated lot, updating the information dynamically. The app accepts checkbox ticks of the parking lot as input, which the parking lot staff or managers would manage. Behind the scenes, MATLAB processes the number of ticked boxes, identifies the available or not, and counts the total number of available parking spaces. The app concisely counts available parking spots and a text indication. Users can quickly assess the overall situation and reduce the time needed to find a parking spot. The car parking indicator app also prioritizes user-friendliness through a three-step process:

1. Marking a slot as occupied or not;
2. MATLAB processing the information;
3. Displaying the total number of available slots and indicating which slots they are.

The process is simplified into three steps to ensure ease of use for benefactors. By minimizing the time spent searching for parking, the app reduces traffic congestion within parking lots. This ripple effect extends to surrounding roads, enhancing overall urban flow. Fewer circling cars mean lower emissions, contributing to a greener environment. Furthermore, future advancements may include predictive analytics that estimate parking availability based on historical patterns or integration with navigation apps for seamless route planning. Machine learning algorithms could also be implemented to learn from user behavior and optimize parking recommendations further.

Introduction

With urban congestion on the rise, efficient parking solutions are in need. Drivers are often challenged with finding a vacant slot in parking lots, using up valuable time and gas in the process. Hence, developing a car parking indicator application will improve efficiency and the overall parking experience. This desktop application will display real-time updates on slot occupancy, determined by sensors installed in each parking slot. Existing systems of manual checking or basic electronic indicators may be unreliable and do not give users immediate information, unlike a live-update screen display.

The beneficiaries of this application include:

1. Drivers looking for parking slots who will benefit from instant updates on parking availability.
2. Parking lot operators and managers tasked with optimizing parking space utilization.
3. Security personnel responsible for monitoring parking lot occupancy.

The main problem this application aims to address is the inconvenience and congestion drivers experience when finding parking slots. Therefore, the application provides increased efficiency and convenience to the drivers, parking lot staff, and security personnel in the car parking process. This application is significant as it allows for more safety in parking spaces as the security personnel can focus more on their job of security and it also enables the drivers to avoid frustration and miscoordination as there is already an indicator on the number of available parking and where they can be found (based on the image). The contemporary issues in engineering that this project aims to address are:

1.) Space Optimization: In overcrowded cities, efficient use of space is crucial. The app guides drivers to available spots, reducing the time spent searching for parking. This optimization helps maximize limited urban real estate.

2.) Traffic Flow: the app aims to improve traffic flow by indicating available parking spaces. Drivers can quickly find spots, reducing congestion and emissions.

3.) Safety: The app enhances safety by preventing illegal parking or blocking emergency routes. They also enable security personnel to do their jobs more freely.

4.) Sustainability: The app contributes to sustainable urban planning. They reduce unnecessary driving, fuel consumption, and pollution.

Functionalities

TABLE I.   List of Functionalities

Persona	Description	Benefit
Drivers	The app provides a real-time display of parking space occupancy in a designated lot. Each slot is marked with its vacancy status, which is displayed on the screen. The	A real-time display provides drivers with instant, updated information regarding the parking lot occupancy.

	information is updated dynamically, and the number of available slots is shown.	This information is easily accessed as it is displayed on screens at the parking lot entrance or through digital signage.
Parking Lot Operators / Managers	This app has checkboxes to tick if someone is parked in a specific slot. The whole process is user-friendly, following the simple procedure of (1) marking a slot as occupied or not, (2) MATLAB processing the information, and (3) displaying the total number of available slots.	Operators can monitor occupancy levels and manage the parking lot more efficiently, reducing congestion and improving the overall parking experience.
Security Personnel	This app can display which spot/s is available for parking.	Security personnel can use the application to ensure all parked cars are in designated areas, enhancing security and order within the parking facility.

Walkthrough

1.) Upon launching the app, users are greeted with a real-time display of parking availability. The window you see right now is the operator's view. This would be where the parking lot operators would update the parking availability. The app would accept checkbox ticks of each slot as input, which the parking lot staff or managers would manage.

As you can see, all boxes are set to open by default, using a **green** lamp and font color as indicators, which both change to **orange** once the box is **checked or ticked** to indicate the slot is closed.

CAR PARKING INDICATOR

● Open	● Open	● Open	● Open	● Open	● Open
☐ Slot 19	☐ Slot 20	☐ Slot 21	☐ Slot 22	☐ Slot 23	☐ Slot 24

● Open	● Open	● Open	● Open	● Closed	● Closed
☐ Slot 13	☐ Slot 14	☐ Slot 15	☐ Slot 16	☑ Slot 17	☑ Slot 18

● Open	● Closed	● Closed	● Closed	● Closed	● Closed
☐ Slot 7	☑ Slot 8	☑ Slot 9	☑ Slot 10	☑ Slot 11	☑ Slot 12

● Open	● Closed	● Open	● Open	● Closed	● Open
☐ Slot 1	☑ Slot 2	☐ Slot 3	☐ Slot 4	☑ Slot 5	☐ Slot 6

Available **15 / 24**

Switch to Driver's View

2.) Behind the scenes, MATLAB processes the number of ticked boxes, identifies available slots, and counts the total number of available parking spaces displayed at the bottom.


Available **15 / 24**

Do note that this is the view that only the parking lot staff and operators can see and have access to, for it serves as the application controller. The data input here is synced with our second window, which is called drivers view.

3.) The driver's view would have a live-updated display containing information that would benefit them more, which we would be able to see at the left corner of the application in the current view.
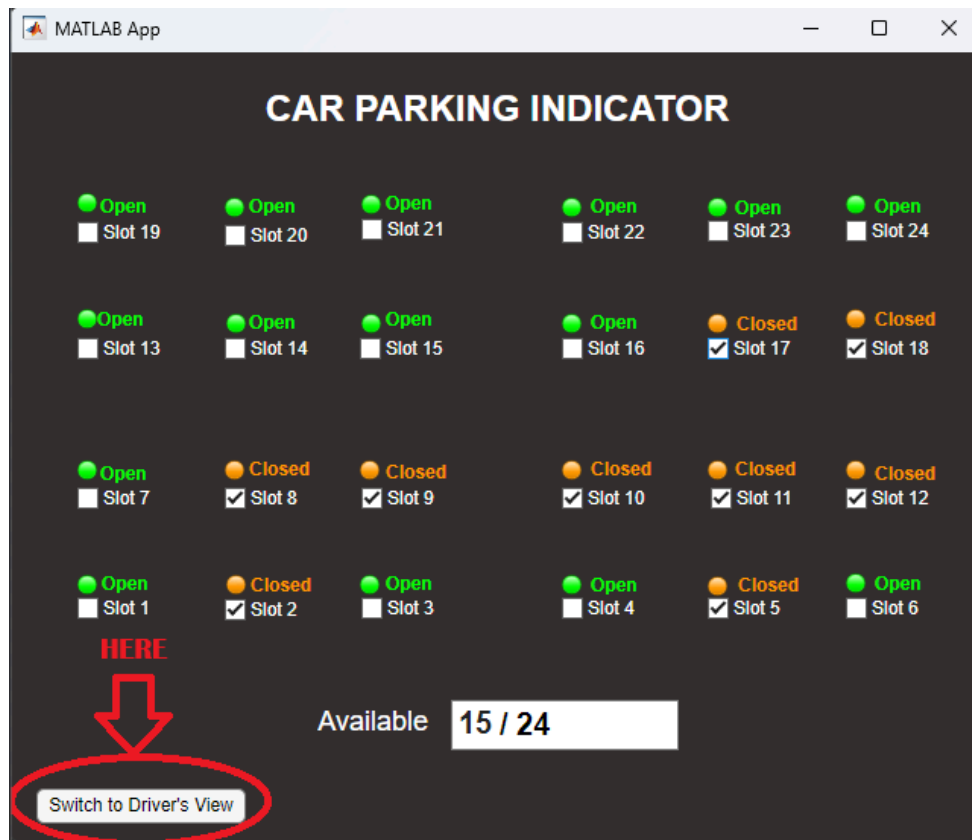
It would bring you here:
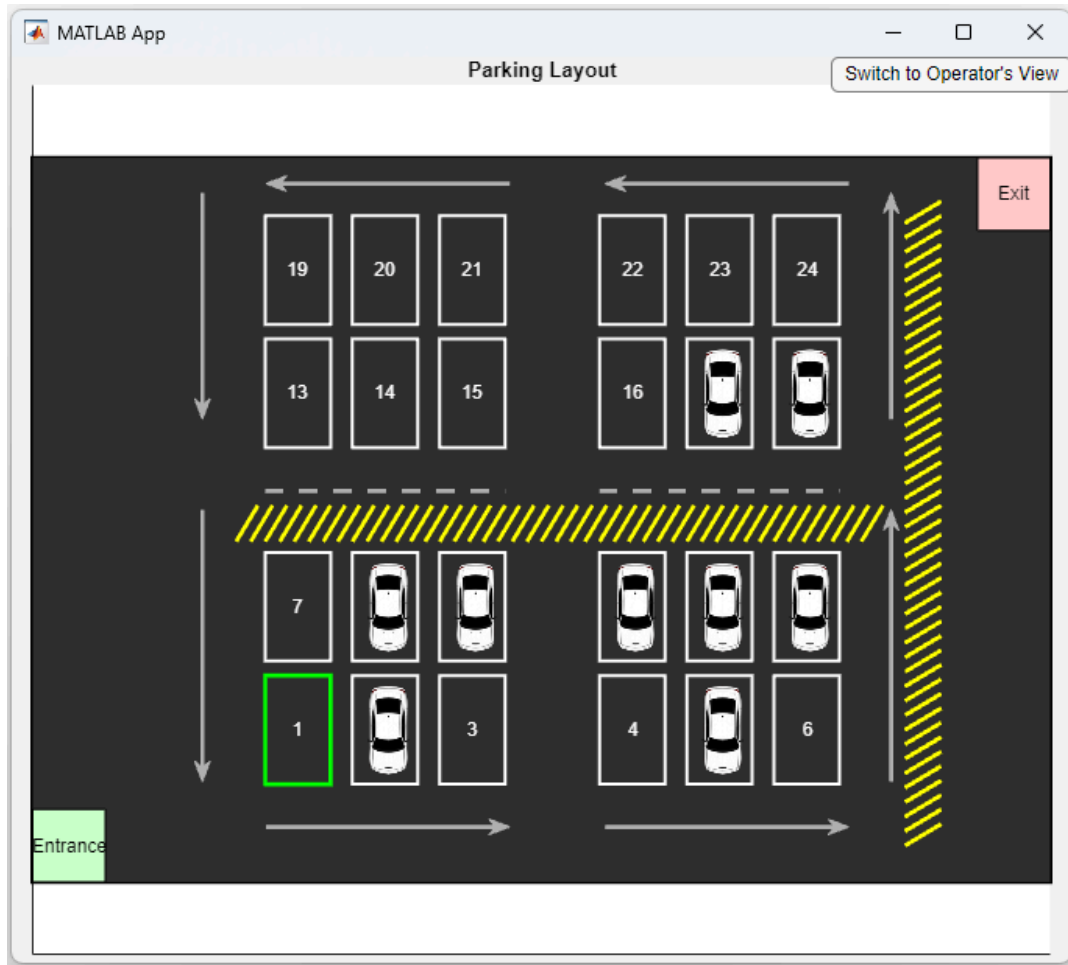
4.) For the driver's view, as you may see on the screen, the layout design is quite different compared to that of the operator's view. It is designed such that it replicates the actual parking lot that the drivers will be going to. It is able to show a live layout that is in coherence with the operator's view *[reference at end page]*, showing which slots are available, and which slots are not.

In this view, the slots that are occupied are able to show **a car, or a pixelated image** of it, in place of the **open slot**. Another notable feature of this view is that it is able to show the **nearest available parking slot** from the entrance using a **distance calculator**, which in this instance is highlighted in green at **slot 1**.
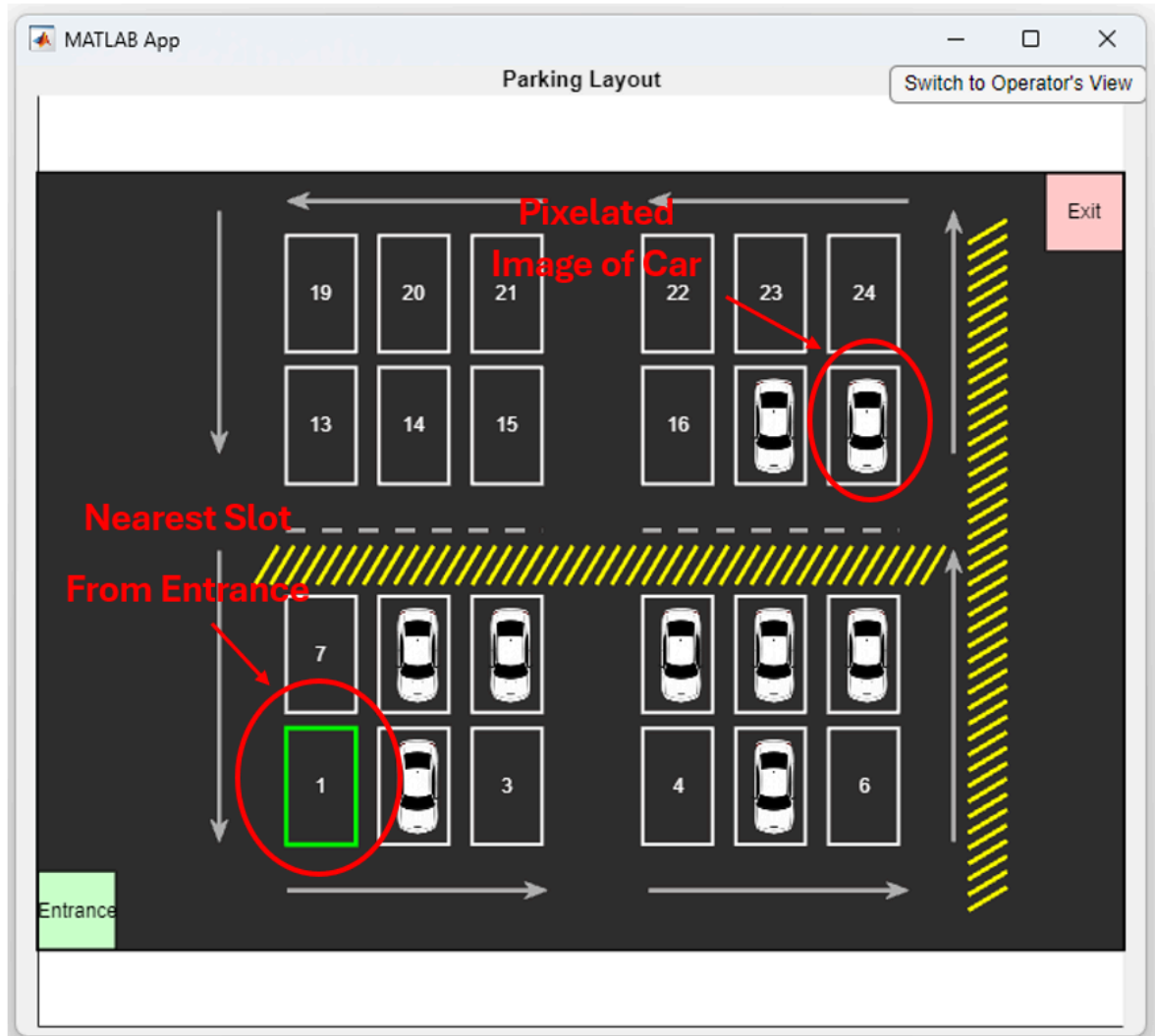
Do note that the drivers will not be able to interact with the app in this view, or in the operator's view for that matter, it will only serve as an indicator for them that is placed on a screen at the entrance of the parking lot.

5.) Users will be able to swap back and forth between the two views simultaneously and adjust when needed. To swap back from the driver's view, use the top left button to switch to the operator's view.
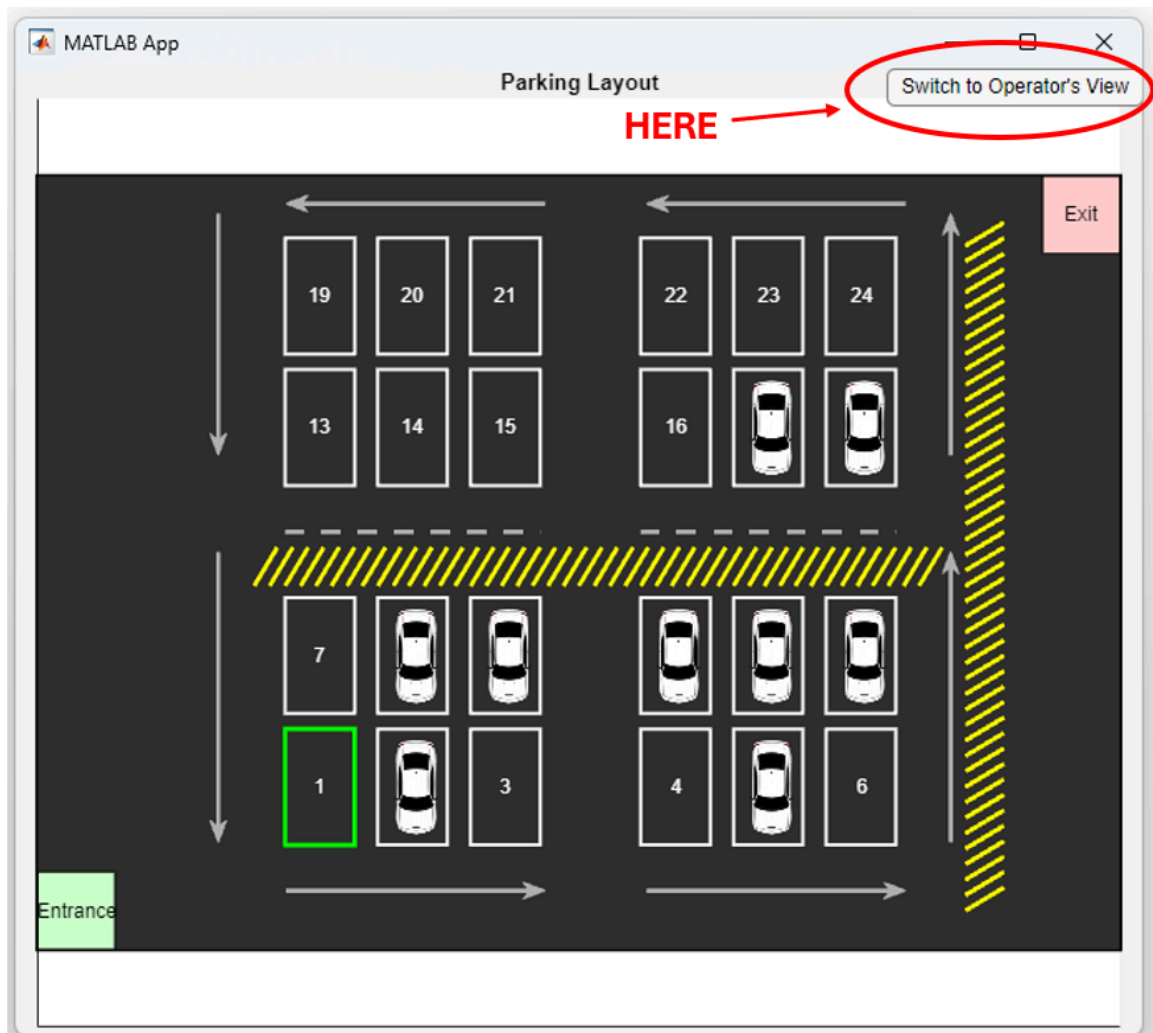
It will bring you back here:

Then you can repeat the process again, updating the number of ticks per slot.

Limitations and Recommendations:

For this app, in reality, the only people who would be interacting with the app itself are the operators, and the drivers would only be able to see on the screen the driver's view. Also, in the app itself, a person can only see **one view at a time**, and not be able to see both views simultaneously.

Furthermore, this brings up a limitation of the app, and it relies upon the judgment and responsibility of the driver to follow the indicated instructions on where the nearest parking slot is, in order for the app to be truly effective.

Nevertheless, this app would serve as a means to help in alleviating the issues with regard to traffic management in areas where cars are parked, as well as providing a basis for a more improved version of this app, which uses either sensors or image processing to make it more efficient in the future.

A view of the two views side to side (for reference):